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Original Article

OUTCOME ANALYSIS AND OUTCOME PROGNOSTIC FACTORS OF TRAUMATIC BRAIN INJURY IN CHILDHOOD

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ABSTRACT

Background

The major cause of morbidity and mortality in children and adult is Traumatic brain injury (TBI). It results in considerable health care cost and, for many survivors, permanent disability

Object

To know factors associated with good outcome and poor outcome in children after severe traumatic brain injury (TBI)

Materials and Methods

A prospective study including 100 children suffering from severe traumatic BRAIN INJURY admitted in (I.C.U.) the Intensive Care Unit of alsader teaching hospital over 2 year period. important demographic, clinical, biological and radiological data were recorded on ICU admission. Glasgow outcome scale (GOS) performed after hospital discharge to defined Prognosis and outcome.

Results

The main cause of trauma was (R.T.A.) traffic accidents (69%) There were31 female patients and 69 male (69%). With the age ranging from the youngest 2 days old and the oldest was 14 yrs old. Glasgow coma scale (GCS) score was<8 scores. The GOS performed within a mean delay of 4 months after hospital discharge was as follow: deaths (19%), vegetative states (2%), severe disabilities (4%), moderate disabilities (15%) and good recoveries (60%). factors associated with poor outcome (death, vegetative state or severe disability) were: GCS ≤8 (P=0.04); Hypoxemia (P=0.02) and sodium level >145 mmol/l (P=0.04).

Conclusions

The most common cause of death and acquired disability is Traumatic brain injuries, Road traffic accident (R.T.A.) is the common cause of severe head injuries among children. Non- reacting pupil to light, low GCS, multiple extra-cranial injury and raised ICP after head injury are The bad prognostic factors for severe head injury. The outcome measure (GOS) is a very blunt instrument, especially for survivors who are not vegetative or severely impaired.

KEYWORDS: Glasgow Coma Scale Score, Traumatic Brain Injury, Children, Pediatric Intensive Care Unit, Prognostic Factors & Head Trauma

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AIM OF THE STUDY

Acute head injury, children, Glasgow coma scale score, intensive care unit, prognosis, trauma.1. Predict the outcome of severe head injury in pediatrics. 2. To determine the factors associated with poor outcome in children suffering from a severe traumatic head injury (HI).

INTRODUCTION

Historical Perspective and Introduction

Neurosurgery began with the treatment of head injuries. The treatment of patients with head injuries consisted mostly of war surgery performed by general surgeons until the end of World War II. Shortly after World War II neurosurgeons specialized in trauma care and developed the first Intensive Care Units in the 1950s and early 1960s in various countries. Computed tomography (which was introduced in the mid-1970s) has dramatically changed the treatment of traumatic brain injury (TBI).

Definitions, General Principles, and Pathophysiology

Definitions

If a force from outside hits the head this force may result in various injuries possibly involving scalp, skull, Dura, brain and their supplying vessels.[3]If a patient has sustained a traumatic brain injury, this fact will alter his level of consciousness in some way. Level of consciousness is usually examined by applying the Glasgow Coma Scale (see later).[2]

General Principles and Pathophysiology

Traumatic brain injury (TBI) is a very common disease in all countries with long-term, often life-long consequences for the patient involved. Primary brain damage cannot be treated, it can only be prevented. “Secondary” injuries to the brain may have intracranial as well as extracranial causes (table 1). Avoidance and treatment of these secondary insults is the core of neurotrauma care. [3]

Table 1: Show the Primary and Secondary Brain Injuries

Primary Damage	Secondary Damage
Hemorrhagic contusion	Intracranial complications; Hematomas Brain edema Increase ICP
Disruption of vessels	
Disruption of nerve fibers	Systemic insults; Hypoxia Hypotension Pneumonia Septicemia Coagulopathy

Head Injuries: Specific Aspects in Children

Epidemiology

Traumatic brain injury (TBI) accounts for most neurosurgical admissions to hospital and remains the most common cause of death in the pediatric population. The estimated incidence of TBI among children aged 0–14 years in the

United States is about 800/100,000/year. Children less than 4 years of age have the highest rate of ED consultations (1,035/100,000), hospitalization (80/100,000), and death (5.7/100,000) if compared with those aged 5–9 years and 10–14 years. Falls are the leading cause of TBI in the pediatrics population, followed by transportation-related injuries and inflicted injuries. The causes of head injury by age are listed in Table (2) Boys and adolescents are more likely to have a TBI than girls.

The mortality rate among children with GCS 3–8 at onset ranges from 20 to 40% [1]

Table 2: Causes of Pediatric Traumatic Brain Injury (TBI) by Age

Age Group	Main Causes of TBI
Newborns	Delivery falls
infant	Falls inflicted injuries
toddler	Falls, transport-related injuries, inflicted injuries
Young-school aged children	Falls, transport-related injuries(mainly bicycle crash)
Adolescent.	transport-related injuries(mainly motor vehicle crash),sport related injuries

Head Traumas in Pediatrics

Although head trauma in children and adults has several similarities, children should not be considered as young adults, given that pediatric patients have a more susceptible cranial vault due to Thinner bones, large head-to-torso ratio, late development of air sinuses and differences in the immune system and in their capability of maintaining body temperature. Furthermore, severe head trauma in children is less frequent than in adults, and the mortality rate is also lower.[4,5,6]

Specific Types of Head Injuries in Pediatrics

Skull Fracture

A skull fracture can be found in 2% to 20% of children that present with severe head trauma. Ninety percent of children with a score of 4 or greater had a skull fracture.[7]

Intracranial Hematoma

Epidural Hematoma

Epidural hematoma is a collection of blood between the innertable of the skull and the dura mater.

Subdural hematoma

Subdural hematomas result from injury to the bridging cortical veins or from the extension of an intracerebral contusion in the subarachnoid space.

Chronic subdural hematomas are usually observed in infants and result from an undiagnosed or conservatively treated acute subdural hematoma. Evacuation of the hematoma through a single- or double-burr hole is usually performed.[11]

Parenchymal Lesion

Contusions

Cortical contusions are found if the accelerated–decelerated brain hits the inner side of the skull.[8]Most of these contusions are located within the brain parenchyma at the floor of the anterior or the middle skull-base, resulting in contusional lesions of the frontal and the temporal lobe surface.[9]

Diffuse Axonal Injuries

Diffuse axonal injuries (DAI; synonym – diffuse white matter shearing injuries) result from severe shear-strain forces during high-speed accidents. Clinically, the patients present in a deep coma with midbrain or brain-stem symptoms.[10]

Intracerebral Hematoma

Intracerebral hematomas are unusual in children and may be the result of focal brain injury or penetrating trauma.

Penetrating Head Trauma

Penetrating head injuries constitute only a small part of the total number of traumatic head injuries but belong to the class of most severe traumatic brain injuries. Surgery should be performed as soon as possible with debridement and proper wound closure.

Child Abuse

It is defined as “non-accidental” or “inflicted” traumatic injury. Ten percent of children younger than 10 years of age hospitalized for head injury and 25% of those less than 2 years of age are victims of child abuse. **The battered child syndrome(BCS)** involves children < 3 years of age with signs of chronic abuse, such as skin and skeletal injuries, burn injuries, and poor nutrition and hygiene. **The shaken baby syndrome (SBS)** resulting from vigorous shaking of the child [2]. The increased head/body size ratio and the weakness of the muscles of the neck of young children favor the violent angular accelerations and decelerations occurring during this type of trauma.

Initial Assessment and Early Management

Initial Assessment of the Head Injured Patient

The main aim of patient care in the early stages of management should be to prevent or minimize the risk of secondary brain injuries and to assess the full extent of the injury.

Clinical History

Concomitant diseases, current medication.

Physical Examination

The initial examination starts with checking and stabilizing vital functions.

Neurological Examination

The level of consciousness is determined by applying the Glasgow Coma Scale Score (Table 3A and 3B). Cranial nerve deficits are examined.

Table 3A: Glasgow Coma Scale Score (Age >4 Yrs)

Eye Opening (E)	Spontaneous	4 points
	To voice	3 points
	To pain	2 points
	None	1 points
Verbal Response (V)	Oriented	5 points
	Confused	4 points
	Inappropriate words	3 points
	Incomprehensible sounds	2 points
	None	1 points
Best Motor Response (M)	Follows commands	6 points
	Localizes pain	5 points
	Withdraws from pain	4 points
	Abnormal flexion	3 points
	Abnormal extension	2 points
	None	1 points

Table 3B: Glasgow Coma Scale Score (Age <4 Yrs)

Eye Opening (E)	Spontaneous	4 points
	To voice	3 points
	To pain	2 points
	None	1 point
Verbal Response (V)	smile, oriented to sound	5 points
	Crying, Consolable	4 points
	Inconsistently consolable	3 points
	Inconsolable, restless	2 points
	None	1 point
Best Motor Response (M)	Follows commands	6 points
	Localizes pain	5 points
	Withdraws from pain	4 points
	Abnormal flexion	3 points
	Abnormal extension	2 points
	None	1 points

Imaging

Computed Tomography (CT)

Is the type of imaging that is the first choice in any head-injured patients in whom an intracranial lesion is clinically suspected[(12)].

Magnetic Resonance Imaging (MRI)

Has several disadvantages and advantages compared with CT in the acute trauma setting.

Cerebral Angiography

Is rarely indicated in the acute examination of a head injury patient. Injuries to cerebral vessels (dissections, carotid-cavernous fistulas may also be demonstrated by cerebral angiography, although CT or MRI angiography has

already replaced it in most cases.[12]

Skull Radiography

We have abandoned plain radiographs and perform CT instead. The indication for CT as the initial examination follows generally accepted rules in neurotrauma care.[12]

Treatment of Severe Head Injuries

Medical Aspects

The rationale of medical management of head trauma is based on the concept of primary and secondary injury. While the primary injury can only be prevented, but not treated, the goal of medical management is to prevent and treat the secondary injury by the appropriate intervention[13].

Pre-Hospital Management

The first priority in children with severe head injuries (i. e. GCS score of < 8) is to perform rapid and complete resuscitation to maintain normal cardiovascular and blood gas parameters. Hypotension and hypoxia cause secondary brain injuries and worsen neurological outcome; thus, they must be identified and corrected as soon as possible with fluid resuscitation (20 ml/kg of isotonic crystalloid in boluses). A better evaluation of neurological impairment is performed using the Paediatric Glasgow Coma Scale for children < 6 years of age and the GCS for older children.

In-Hospital Management

Once adequate ventilation and sedation are established, the core of the treatment is the control of intracranial hypertension, appropriate sedation, careful management of metabolic issues and fluid therapy. Intracranial pressure monitoring is indicated for children with a GCS less than 8, but it may also be employed for children in whom the serial neurological examination is not feasible.

Glasgow Outcome Scale

This scale is based on the overall social capability (or dependence) of the patient, When 150 Glasgow survivors after severe head injury were classified independently by a neurologist and by a neurosurgeon there was over 90% agreement, both for assessments at 6 months and at 12 months after injury.[14]

The Glasgow Outcome Scale has Five Categories

Good Recovery: (Score =5)

The patient is able to participate in normal social life and could return to work.

Moderate Disability (Independent but Disabled): Score=4

These patients look after themselves, can travel by public transport, and some are capable of work may have memory deficits or personality changes, varying degrees of hemiparesis, dysphasia or ataxia, post-traumatic epilepsy, or major cranial nerve deficits. [14]

Severe Disability (Conscious but Dependent): Score=3

Patients in this category are dependent on some other person for some activities during every 24 hours.

Vegetative State: Score=2

Non- sentient survival, defined by Jennett and Plum in 1972, is that there is no evidence of psychologically meaningful activity, as judged behaviorally.

Dead =1

Patients and Methods

This is a prospective study, we collect a 100 patients (total no.) with traumatic brain injuries their age was less than 14 years and admitted to alsader teaching hospital ICU during a 2-year period (2010-2012). The data were collected from the patient clinical notes with multiple contributors. Patients were admitted directly after the accident or referred from other non-specialized hospitals within1- 6 hours of injury. Glasgow coma scale(GCS) score recorded on arrival with a full examination and underwent computed cerebral tomography (CT) scan for the brain as soon as possible. The patients' medical files were prospectively reviewed, and the following data were recorded: **Age, gender, vital signs (heart rate, respiratory rate, systolic and diastolic blood pressure), body temperature in °C, GCS score, cause of injury, pupil response, motor deficit, convulsion, use of mechanical ventilation, presence of shock or arterial hypotension, cardiac arrest, fluid intake volume, brain CT-scan result and use of catecholamine** .Biochemical parameters measured on admission and during the ICU stay were: **Hemoglobin concentration, platelets count, serum glucose and sodium levels and blood urea, general urine examination**. Cranial CT-Scan was done in all patients on admission. Neurological state was assessed using the GCS score on hospital arrival before the use of sedation. The anticonvulsants were used if the patient developed a seizure. Some patient treated by surgical intervention when indicated. we daily recorded mean of Na, K and blood sugar levels for all patients .and we have recorded the development of secondary systemic insults (SSI) on admission and during ICU stay. SSI were divided into subgroups of: Respiratory (hypoxemia), circulatory (hypotension or arterial hypertension), metabolic/ electrolytic SSI (anemia (Hb<8.5 g/dl), hyperglycemia (>11 mmol/l)or hypoglycemia(<2.8 mmol/l), hyponatremia(<130mmol/l), hypernatremia (>140mmol/l) and hyperthermia). During the ICU stay all complications were recorded: Nosocomial infections (pneumonia, urinarytract infection, meningitis, and septicemia). Glasgow Outcome Scale (GOS score) was performed after hospital discharge by neurosurgeon and pediatric physicians. This score was previously used to assess prognosis in children suffering from head trauma.

Our Patients were Divided into Two Groups

GOS (I): Patients with good outcomes involving patients having a good recovery and/or moderate disability.

GOS (II): Patients with poor outcome involving patients having a severe disability or persistent vegetative state or deaths.

DISCUSSIONS

Age Distribution

The (young – school-aged children) was the commonest age group in this study (36%), while (newborns) was the least once (8%). The cause may be that the young – school-aged children are more activeand their exposure to trauma is higher, while newborns under more family care and observation. but one of the results of this study is that no significant relation between age and outcome (P=0.37). that is agreed with other study of. White JR, Farukhi Z, Bull C, et al that reports that age is not a prognostic factor for the outcome of patients.[15] . Luerssen TG, Klauber MR, Marshall LF, et al

report that the influence of age on children outcome is controversial.[16]

Table 4: Age Distribution

Age	Percentage
newborn	8%
infant	13%
toddlers	20%
young school - aged children	36%
adolescent	23%

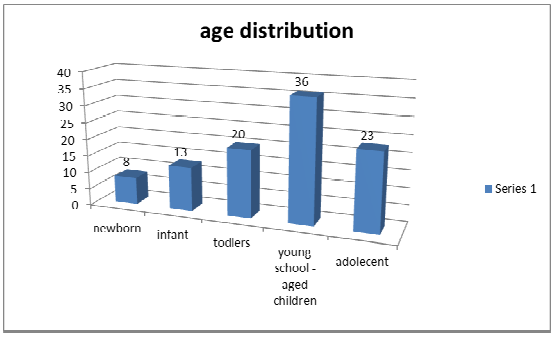

Figure 1: Represents the Age Distribution

Gender

In this study male patient more susceptible to head injury than the female patient (male: female ratio = 2.2:1). so. because of greater exposure to trauma and more risk-taking behavior during life and exposure of males to RTAs leads to a male: female ratio of head injury incidence of about 2.2:1. In compare with the study of Jess F. Kraus, of 313 individuals 263 were males (84.0%) and 50 were females (16.0%). there was no gender effect on the outcome of severe head injury (no significant p. value). That is same as the result of the study of Jess F. Kraus., Corinne Peek- Asa, (43) the GOS scores at discharge did not show any significant effect by gender, 60% of females & 51.4% of males had poor outcomes. (17).

Table 5: Represents the Gender

Gender	No.	Percent
Male	69	69%
Female	31	31%

The Time of Admission

Good outcome in this study was related to early admission to the hospitals than those with late admission. (significant p. value). In similar studies admission time regarded as one of the prognostic factors as in Marton E, Mazzucco M, NascimbenE, et al.(that goes with our study results) who report that 30–50% of all patients with TBIs die at the scene of the accident or during transport to the hospital as a result of their primary damage.

Table 6: Shows the Time of Admission

Admission Time	Percentage
1 hrs -2 hrs	61%
3 hrs- 4 hrs	20%
5 hrs- 6 hrs	19%

Glasgow Coma Scale at the Time of Admission (GCS)

GCS at time of admission 8 scores (8%) was the least common in this study, while GCS 5 score (26%) at time of

admission was the commonest one. the most important prognostic factor for the outcome in this study was the low GCS & the severity of the head injury. a significant poor outcome according to P.value (P=0.04) associated with low G.C.S.

This agreed with the study of Narayan RK, Greenberg RP, Miller JD, et al, in which positive predictive value of 77% for a poor outcome (dead, vegetative state or severely disabled) was recorded for patients with GCS score of 3-5 and 23% poor predictive value for a GCS score of 6-8.[19]

Table 7: Glasgow Coma Scale Score at the Time of Admission G.C.S

Glasgow Coma Scale Score	Percentage of Patient
3	12%
4	17%
5	26%
6	23%
7	14%
8	8%

The Cause of Trauma

Road traffic accident RTA is the main cause of trauma (69%)in this study, and FFH fall from height (29%) is the second cause, while the assault injuries (2%)was less common. This goes with result of the Europe studies of Tagliaferri F, Compagnone C, KorsicM,et, al(60% of TBIs were caused by RTAs (in Sweden & Spain); 15% (in Italy and in Norway) were caused by FFH.[20]poor outcome associated with accidents than falls according to P. value (P<0.003) in this study, and this similar to the study of Peter C. Whitfield, Elfyn O. Thomas, et al.[21]

Table 8: Shows the Cause of Injury

Cause of injury	No.	Percent
Road traffic accident	69	69%
Fall from height	29	29%
Assault	2	2%

The Radiological Finding

Linear skull fracture (42%), subgalial hematoma (35%) and cerebral contusion (34%)were the most common results of the study.

That same as the findings of the study of AbrarAhadWani, A. U. Ramzan, A. R. Kirmani, et al, the CT scan show that 14 of 48 patients develop intracranial hemorrhage, 18 of 48 patients complaining from contusion, 14 of 48 patients with brain edema & 2 of 48 patients was normal.[22] The bad prognosis was associated with intracerebral hematoma (P. value) (P= 0.03), Especially epidural hemorrhage that can be diagnosed by C-T scan, in order to operate them if the hematoma is significant in size and with mass effect. The worst outcome-associated with intracranial hematomas byThe study of JAMES S.HEIDEN, RICHARD SMALL, WILLIAM CATON, et al,(51) that disagree with our result.

Table 9A: Show Skull x-Rays Finding in our Study

Skull x-Ray	Percentage
Pneumocephalus	11%
Linear Skull fracture	42%
Depressed Skull fracture	15%

Table 9B: Show Cerebral CT Scan Findings in our Study

CT Scan Finding	No.	Percentage
Normal CT scan	14	14%
Subgaleal hematoma	35	35%
Cerebral edema	30	30%
Cerebral contusion	34	34%
Extradural hematoma	6	6%
Subdural hematoma	17	17%
pneumocephalus	11	11%
Diffuse axonal injury	4	4%
Linear Skull fracture	42	42%
Depressed Skull fracture	15	15%
Subarachnoid hemorrhage	5	5%
Intra cerebral hematoma	7	7%

The Complication

The hospitalization time mean was 16.45 days. And the mean of ICU stay was 9.015 days, The nosocomial infection was the commonest complication (27%) especially UTI (73%)which was a good prognostic outcome, while fat embolism was the least(1%) . the least infection was septicemia (11%) and related to a poor prognosis and poor outcome. This agree with the study of Garner JS, Jarvis WR, Emori TG, et al. [23](SSIs) developed in(83%) of patient in ICU stay in this study mainly anemia (59%), hyperthermia (51%)and the hypoglycemia(9%)was least one. the study shows that high random blood sugar, hypoxia, and hyponatremia on admission was associated with bad prognosis. (24,25,56) also severe HI .causing severe brain edema that was very harmful to brain tissue. High Na+ >145 mmol/l during ICU stay was associated with a poor prognosis. This explains that those with high blood sugar in the high-risk group, with a low GCS on admission. Also, hypernatremia causes brain shrinkage and vascular rupture and permanent neurological damage after cerebral bleeding, subarachnoid hemorrhage.[27] hypotonic hyponatremia can cause cerebral edema. [27]with intracranial hypertension and brain injury. That worsening the post-traumatic lesion. Secondary systemic insult associated with a poor prognosis (significant p. value). This similar to the study of Rovlias A, Kotsou S and Bochicchio GV, Sung J, Joshi M, Bochicchio K, Johnson SB, Meyer W, et al.andAdrogué HJ, Madias NE.(24).

Table 10A: The Main Complications During Hospital Admission

Complication	Number	Percentage
nosocomial infections	19	27%
Bed sore	4	6%
diabetes insipidus	2	3%
fat embolism	1	1%
Bed sore	4	6%
gastrointestinal hemorrhage	2	3%

Table 10B: the Main Nosocomial Infection

Nosocomial Infection	Number	Percentage
Pneumonia	13	68%
Urinary tract infection	14	73%
Meningitis	8	42%
Septicemia	2	11%

Table 10C: Shows the Percentage of each Secondary Systemic Insults

Secondary Systemic Insults	Percentage
hyperthermia(>38.5)	51%
hyponatremia (<130mmol/l)	17%
arterial hypotention	37%
hyperglycemia (>11 mmol/l)	18%
hypoxia	59%
hypoglycemia(<2.8 mmol/l)	9%
anemia (Hb<8.5 g/dl)	42%
hypernatremia (>145mmol/l)	11%

The Outcome after Hospital Discharge

Good outcomes 4 months after injury were recorded with high GCS score at initial trauma if compared with other studies as in. Jagannathan J, Okonkwo DO, Yeoh HK, et al.[28]However, post-concussion syndrome were observed many patients. The motor Weakness in this study was most late sequelae as compared with other studies of Kramer ME, Chiu CY, Walz NC, et al, in which The commonest sequel was memory and neuropsychiatric disturbances.[29]

Table 11A: The Outcome of Severe Head Injury According to Glasgow Outcome Scale (GOS) Score

GOS	Number	Percentage
Death	19	19%
Vegetative state	2	2%
Sever disability	4	4%
Moderate disability	15	15%
Good recovery	60	60%

Table 11B: The Relation of Age and the Outcome

Age	Good Outcome		Poor Outcome	
	Number	Percent	Number	Percent
newborn	5	63%	3	37%
infant	8	62%	5	38%
toddler	13	65%	7	35%
Young school – aged children	20	56%	16	44%
adolescent	12	52%	11	48%
p. value(p=0.37)				

Table 11C: The Relation of Gender and the Outcome

Sex	Good Outcome		Poor Outcome		P. Value
	No.	Percent	No.	Percent	
Male	48	69%	21	31%	0.057
Female	20	64%	11	36%	0.056

Table 11D: The Relation between the Time of Admission and the Outcome

Time of Admission	Good Outcome		poor Outcome		P Value
	Numbers	percentage	Numbers	Percentage	
1 hrs – 2 hrs	49	71%	12	19%	0.02
3 hrs – 4 hrs	11	55%	9	45%	0.03
5 hrs – 6 hrs	8	42%	11	58%	0.03

Table 11G: Represents the Relationship between the Admission GCS and the Outcome

Glasgow Coma Scale	Good Outcome		Poor Outcome	
	Numbers	Percentage	Numbers	Percentage
3	0	0	12	100%
4	10	59%	7	41%
5	23	88%	3	12%
6	22	95%	1	5%
7	13	93%	1	7%
8	7	88%	1	12%
P value	0.03		0.04	

Table 11H: Show the Relation of the Cause of Injury and the Outcome

The Cause of Injuries	Good Outcome		Poor Outcome		P Value
	No.	Percent	No.	Percent	
Road traffic accident	48	69%	21	31%	0.003
Fall from height	26	89%	3	11%	0.004
assault	1	50%	1	50%	0.002

Table 11I: Represent the Relationship between the CT Finding and the Outcome

Cerebral Lesion	Good Outcome		Poor Outcome		P. Value
	Number	Percentage	Number	Percentage	
Negative brain C.T. scan	12	85%	2	25%	0.02
Hemorrhagic contusion	25	73%	19	27%	0.03
Extra Dural hematoma	4	67%	2	33%	0.03
Sub Dural hematoma	10	76%	3	24%	0.03
Sub arachnoid hemorrhage	2	40%	3	60%	0.02
Intra cerebral hemorrhage	2	28%	5	72%	0.03

Table 11K: The Relation between the Nosocomial Infection and the Outcome

Nosocomial Infection	Good Outcome		Poor Outcome		P Value
	No.	Percent	No.	Percent	
Pneumonia	9	69%	4	31%	0.03
Urinary tract infection	12	85%	2	15%	0.02
meningitis	2	25%	6	75%	0.03
septicemia	0	0%	2	100%	0.01

Table 11L: Shows Secondary Systemic Insult Association with the Outcome

Secondary Systemic Insult	Good Outcome	Poor Outcome	P Value
	percentage	percentage	
hyperthermia(>38.5)	66%	24%	0.01
hyponatremia (<130mmol/l)	59%	41%	
arterial hypotention	55%	45%	
hyperglycemia (>11 mmol/l)	32%	68%	
hypoxia	29%	71%	
hypoglycemia(<2.8 mmol/l)	92%	8%	
anemia (Hb<8.5 g/dl)	34%	66%	
diabetes insipidus	30%	70%	
hypernatremia (>145mmol/l)	33%	67%	

CONCLUSIONS AND RECOMMENDATION

CONCLUSIONS

- The commonest cause of morbidity and mortality among children in Basrah(Iraq) was the TBI.
- The patient age and sex have no significant prognostic effect onpatients outcome after head trauma.
- Deaths of children mainly caused by RTA.
- The SSI and it's number was associated with a high mortality rate and bad prognosis.

RECOMMENDATION

- Well trained first aid staff and high standard trauma centers can greatly reduce deaths and disability from RTA injured patients.
- Advanced imaging facilities should be available for early diagnosis, especially C-T scan.
- Frequent checking of GCS and monitoring of intracranial pressure in ICU.
- The subspecialty of pediatrics neurosurgeon is important in follow up of patients.

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